Business Process Improvement in ERP post-implementation context

University of Oulu
Department of Information Processing Science
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Sami Leinonen
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Abstract

The purpose of this research has been studying the role of Business Process Improvement and its tools, techniques and methodologies in such a context, where an ERP system has been fully adopted to the organization.

In addition to analyzing the tools relating to BPI, also the subcategories of BPI are researched. These include Business Process Automation, Business Process Optimization, and Business Process Integration. All these can be seen as a subset of BPI, so they cannot be exluded when studying Business Process Improvement.

There has been an additional focus on the structures of these business process related terms because there are misintepretations among the concepts and terms even amongst the professionals who have researched the same discipline.

Keywords

business process improvement, business process optimization, business process integration, business process automation, ERP assimilation, post-implementation

Supervisor

Ph.D., Kaisu Juntunen

Foreword

The motivation to writing this paper came from working three months in a company that used SAP ERP in its functions and learning to use it in various scenarios ranging from invoice handling to managing accounts ledger as a financial assistant. I most likely wouldn't be here typing this paper, though, if it wasn't for the great people around the workspace always willing to help if and when help was needed. The extend of use and experience gained in SAP would not been possible if such strong support wouldn't have been existed. While I haven't studied accounting or used such ERP systems before, the experience has given a permanent spark of interest to the discipline, ERP systems and the peculiar relationships between people, processes and the system.

I would also like to thank my advisor on this study, Ph.D. Kaisu Juntunen for guiding through this process and initially advising me to write the paper in English. Using English was clearly a right choice for working in this area of expertise, and using Finnish would have been most likely been restrictive in this department, even though I have no issue in writing in Finnish either. A thank-you is necessary also for the motivation given throughout the writing process.

Sami Leinonen

Oulu, May 8, 2015

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1. Introduction

In this paper we try to define the methodologies of Business Process Improvement (BPI) and the terms related to it, the underlying potential issues that different organizations face in its business processes, and the benefits that Business Process Improvement offers to an organization in such organizational context which already has got deployed an enterprise system to be used in its business processes and business activities.

To analyze the different methods in Business Process Improvement it is also needed to classify and structure the methods into coherent categories for enhanced understanding of the relationships between all these solutions and methodologies and enhanced discussion of all these major concepts that are used in comparin the methodologies.

1.1 Purpose of study

The purpose of this study is to investigate the role of Business Process Management strategies in a post-implementation enterprise systems environment and find out what kind of methods and tools there exist in trying to improve or manage the underlying Business Processes in an organization which has already adopted some enterprise system to be used in its processes. The purpose also includes investigating the requirements for using these methods and the activities in which the fit or alignment between the enterprise systems and business processes is achieved.

There is also an underlying goal for future research of structuring all found methods by their suitability such as methodology requirements regarding organization size, frameworks used, technologies adopted, human resources, expertise, organizational structure or flexibility in integrating them into a whole organization or process which is using an enterprise system on some level of activity. Another

Another goal in making this study lies in structuring all the major terms and concepts into a coherent entirety because the discipline of Business Process Improvement, and especially Business Process Management, are littered with misintepreted knowledge amongst the researchers. Research made from a single subject can carry different ambivalent terms even while the topic and results were the same. There is a need for an uniform field of terms and concepts that don't get cluttered multiple other terms. According to Marjanovic and Roose (2011), it is a very well-known fact that key terms such as BPM or Business Intelligence are widely misinterpreted even within the respective communities.

1.2 Theoretical background

Business Process Improvement (BPI), the systematic examination and improvement of administrative processes (Page, 2010), has been a major concern to numerous companies during the last couple decades. The term itself was conceived back in 1991 in the book of H. James Harrington's Business Process Improvement, and it still today a current topic for many businesses, small or large.

While in the beginning of 1990s the businesses were more focused on total approaches such as business process redesign or Business Process Reengineering (BPR), in the later years enterprise software applications such as ERP (enterprise recourse planning) or CRM (customer relationship management) became a popular way to standardize the processes alongside with workflow systems. In controlling the processes, there has also been an emphasis on Business Process Management Systems in automating these processes. (Harmon, 2014). In the end, these systems are only tools, and not final solutions.

ERP projects continue indefinitely, they do not have an ending. In 2014 Galy and Sauceda in their study to research the effects of managerial actions and financial results discovered the need of analysis of the post-implementation stage efforts of ERP projects. By their definition, there lies a clear correlation between process management and financial results, and that three different stages exist regarding ERP projects: project stage, shakedown stage and onward and upward stage. In unison, Liu, Feng, Hu and Huang (2010) mention that the focus has been mostly in ERP implementation and adoption in previous literature, and assimilation stage has been researched only recently by some. While the post-implementation efforts and stage have been mentioned in papers multiple times, there still is a common belief that ERP implementation project is finished chronologically after it has been deployed to the organization (Stohr et al., 2012).

1.3 Study problem

Enterprise systems and software can be seen as a means and a foundation for an organization's Business Process Improvement initiative, but it is not entirely clear if and how Business Process Improvement activities and strategies such as Business Process Integration, Automation and Optimization are used after the system, such as an ERP system, has been adopted to the organization and its processes. Business Process Improvement is usually used when designing and implemeting ERP systems, but its role is often unclear when a system has already been deployed to an organization. Does post-implementation context require different initiatives, tools and techniques to be used and what they are, do the techniques need to be modified, how Business Process Improvement is carried out in such context, and what are the interactions and relations between all the tools and techniques used? These are the main questions that are the subject of this study.

1.4 Relation to previous studies

Some indications of the need for future research on business process improvement activities in post implementation context have already been seen from previous research regarding BPI. In example, Laukkanen, Sarpola and Hallikainen (2005) indicate that influence of ERP system adoption should be studied more for future research. Samaranayake (2009) writes in unison telling that there is limited research on Business Process Improvement particularily within ERP systems.

In similar manner, also Reiter, Fettke and Loos (2013) mention that interrelationships of business processes, ERP system itself, and the organization as a whole need further investigation.

1.5 Research restrictions

This research focuses only on the iterative, continuous and gradual Business Process Improvement methodologies instead of total approaches such as Business Process Re-engineering which contain a radical redesign aspect of not only Business Processes themselves, but also the whole organization structure as well. Business Process Integration, Optimization and Automation are defined as subprocesses of Business Process Improvement, and they all share the initial iterative improvement perspective of Business Process Improvement which itself can be seen as a subprocess of Business Process Management as shown in Figure 1 by Harmon (2003). Business Process Management isn't used in this research, but all of this subprocesses are, since BPM can be too general and wide description to be used when trying to research spesific tools, methodologies and techniques. Business Process Management as a term can referenced, though, if needed, but it isn't used as a basis for the literature review.

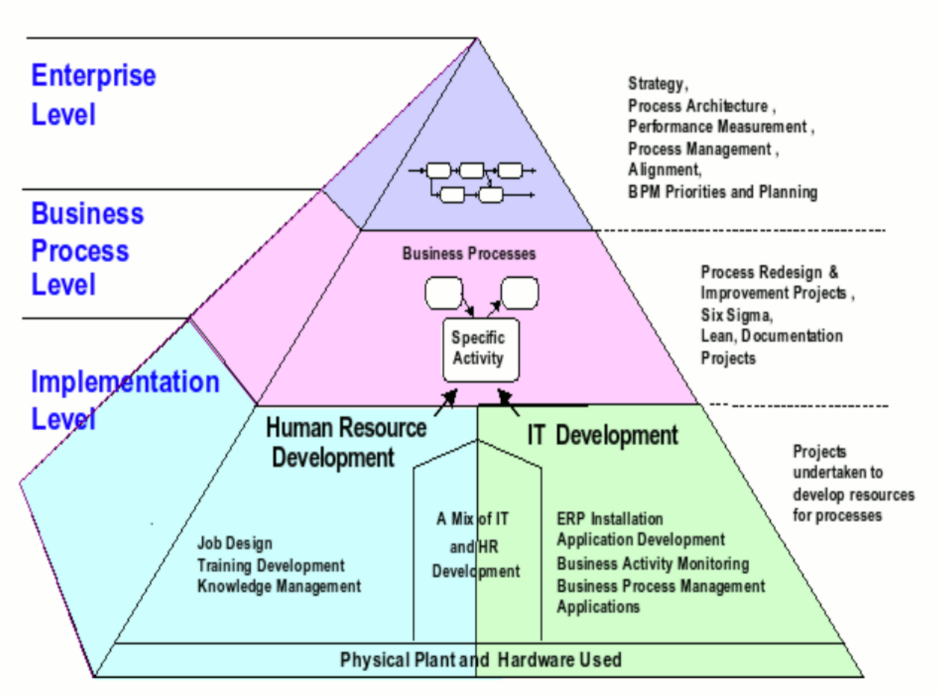

Figure 1. Harmon (2003)

The research only addresses these concepts in the context of ERP systems such as SAP or Oracle. Similar enterprise systems in the wake of ERP systems and enterprise systems are CRM (Customer Relationship Management) systems, but they are excluded from the research to focus strictly on the nature of ERP systems. This is not only because of the differences between these two systems, but also because of the ease of focus on some particular technology and the personal experience of the writer of this study.

1.6 Structure of study

The structure of this study is organized as follows: first chapter includes the introductory part of this study, second chapter defines the major concepts relating to the research, third chapter specifies the research method used in this study, the fourth chapter analyses and reviews the material collected relating to the research, and the fifth chapter addresses the conclusions, implications and future research made in the analysis chapter.

This paper also includes foreword, abstract and table of contents alongside with appendix A and references at the end of the paper.

2. Major concepts

In this chapter the concept of Business Process Improvement and its subcomponents will be defined in detail for further and deeper understanding prior to the latter literature review, study findings and and data analyzing.

2.1 Business Process

According to Davenport (1993), a (business) process is a structured, measured set of activities designed to produce a specified output for a particular customer or market. It implies a strong emphasis on how work is done within an organization, in contrast to a product focus's emphasis on what, a process is thus a specific ordering of work activities across time and place, with a beginning, an end, and clearly identified inputs and outputs: a structure for action. A more recent definition comes from 2004 by Aguilar-Savén: "A business process is the combination of a set of activities within an enterprise with a structure describing their logical order and dependence whose objective is to produce a desired result".

Armistead and Machin (1997) simplify the concept by dictating that business processes are a series of interrelated activities, crossing functional boundaries with inputs and outputs.

2.2 Business Process Management

By the definition from Smith and Fingar (2003), Business Process Management is the approach of managing the execution of IT-supported business operations from a managerial process view other than a technical perspective. Business Process Management follows a managerial lifecycle of planning, organizing, staffing, directing, controlling and budgeting, and the application of this cycle into the organization's business processes (zur Muehlen & Ho, 2006).

Lee and Dale (1998) define Business Process Management as "both a set of tools and techniques for improving processes and a method for integrating the whole organization and it needs to be understood by all employees".

2.3 Business Process Improvement

Business Process Improvement (BPI) is an incremental bottom-up enhancement of existing processes within functional borders (Davenport, 1993). The improvement practice is continuous, but the time required for one-time changes is short. The type of change in the improvement is cultural, but the typical scope is narrow, usually within functions only.

Another general description depicts Business Process Improvement as an systematic approach to help organizations to archive significant changes in the way they do business. Business Process Improvement can be measured in such terms as lead time, service time, wait time, and resource utilization (Reijers & van der Aalst, 2005).

Organizational Business Process Improvement is conducted to support numerous organizational objectives such as customer satisfaction, business profitability, market share, product and service quality, cost reduction, cycle time reduction. There are numerous reference models, standards and other improvement technologies available to support performance improvement. Some of these are discipline-oriented, while others are discipline-neutral to serve the overall enterprise. (Siviy, Kirwan, Marino, & Morley, 2008)

2.4 Business Process Automation

The area of Business Process Automation (BPA), which is sometimes also called workflow management, uses precise descriptions of the business processes to guide the performance of business activities. Work is delegated to either human components or software applications, and these resources then execute the given tasks. In BPA, the progress of all events can be tracked and logged, and this can be exploited in the act of process mining. (Hofstede, van der Aalst, Adams and Russell, 2009)

Business Process Automation allows the execution of workflows across multiple applications and processes through the linkage between process design and application integration services (Melchert, Winter and Klesse, 2009). BPA not only automates business activities, but it also helps to improve and simplify certain workflows.

2.5 Business Process Integration

Process integration aims to produce descriptions and merge similar business activities into a standardized system. In the context of business processes, integration typically means the merge of two similar processes to create a new, single process to replace the original processes. (Morrison, Menzies, Koliadis and Ghose, 2009.) Integration also enables the process of Business Process Automation, and it strengthens the capability to integrate entire business processes not only within an organization, but also between different organizations (Linthicum, 2000).

Business Process Integration tries to define a standard business process model from all the systems included in the enterprise by analyzing specific events, information flow, sequences, hierarchies and and execution logic. BPI solutions enable the utilization of existing systems by automating and managing the business processes and activities spanning all these systems, and bringing cost-effective solutions in comparison to developing new functionalities to the legacy systems. (Papazoglou & Ribbers, 2006)

2.6 Business Process Optimization

Business Process Optimization is a systematic approach that emphasizes repeatability and disregards improvement efforts that are only one-time. BPO enables such business agility that can potentially transform the entire business to such a state which utilizes the technology in use in a better way. BPO provides the monitoring of different business events and activities with corrective actions in mind for better business performance. (Arsanjani et al., 2012)

2.7 Enterprise Resource Planning

Shang and Sheddon (2000) define Enterprise Resource Planning (ERP) as integrated, enterprise-wide, packaged software applications that impound deep knowledge of business practices accumulated from vendor implementations in many organizations. ERP systems have been adopted by organizations throughout the world with varying results of success, and implementing them is a complex, lengthy and expensive process (Shanks et al., 2000) Implementation of these ERP systems requires both IT and business professionals working together to define new operational and managerial processes, since ERP software is a semi-finished product in nature, meaning that organizations and implementation partners can configure them based on organization's business needs.

Some well-known examples of ERP systems include SAP R/3, Oracle Applications, PeopleSoft and Baan (Chand, Hachey, Hunton, Owhoso, & Vasudevan, 2005).

3. Research methodology

In this chapter, the methodology used in this research is defined and captured by depicting the process of material collection, usage and restrictions related to the making us of the material collected.

3.1 Material collection

The literature search began by constructing the keywords that are going to be used in this research. Because of the interlapping nature the terms related to business process improvement, some compromizes needed to be made to how the keywords are generated. In example, the search term “business process improvement” is split into two different versions; “business process improvement” and “process improvement”. During the research it was seen that both terms were sometimes used interchangeably while the terms are not exactly the same by meaning and description.

In similar manner also the keywords “Business Process Automation”, “Business Process Optimization” and “Business Process Integration” were split into two versions of themselves respectably. Again, there was a risk of making the one term into two different ones, but this was seen unimportant since the area and field of these terms must still relate to enterprise systems, and ERP in specific, in general anyways.

The material search was targeted to ACM Digital Library's, IEEE/IEE Electronic Library, EBSCO, ProQuest, SpringerLink, ScienceDirect and the journal articles, conference papers, proceedings and reviews provided by all these databases. Appendix B contains the database results according to spesific databases and keywords used. All results were not used or attached to the literarure review, and the used articles are also shown in the same figure.

The database search was done on between 18th and 24th of March, 2015.

3.2 Research method

This research uses Systematic Literature Review as its basis. The purpose of this method is to investigate the major concepts in the related field and their relationships which fits the purpose of the overall purpose of this study.

SLR consists of three different stages: planning, review, and reporting (Keele, 2007). In this paper this translates to the chapter of research method and the next chapter where I will be analyzing, reviewing and making comparison of the resulting data collection.

3.3 Research method usage

SLR consists of three different stages: planning, review, and reporting. In this paper this translates to the chapter of research method and the next chapter where I will be analyzing, reviewing and making comparison of the resulting data collection. The

method is used step by step by the different stages indicated by the Systematic Literature Review method.

3.4 Research method restrictions

The research method focuses on academic journals and conference proceedings in the field of Information Systems and Computer Science, and specifically in the area of Enterprise Systems such as ERP. Books, internet articles or other means of information are disregarded in this section of literature review, although additional information was used in the introduction and BPI definition chapters of this paper. No reference to these books or articles is made in this literature review.

Secondly, other research methods restriction was made relatting to the date of the academic journals and conference proceedings. The year 2000 was made as the back line for paper dates. Papers older than this year are not brought in to the review, and they are also not included in the material collection findings. If there was an option to limit to papers more recent than year 2000, it was used in the database search tools. If not, they were manually omitted from this research.

4. BPI in post ERP-implementation context analysis

Some benefits can only be reaped in the assimilation phase of ERP projects. These benefits surface from an extensive use of ERP in the organization's business and decision making processes. (Liu et al. 2010) Furthermore, there are three levels of depth in the assimilation of an ERP system, which are defined by Liu et al as supporting business strategy, supporting operation decision making, and supporting business process, the depth being highest at the strategy level. When the extend of assimilation reaches certain levels or activities, the ERP system itself can be used for Business Process Improvement. If ERP is used only for supporting the existing business processes, the data derived from the system isn't carried out to operational decision making for improving business processes. Process mining provides detailed event logs from the system used, so not utilizing them can be a missed chance for the organization.

4.1 Technology-based solutions

If process data isn't readily available and analyzable from the system, though, sometimes discrete process mining techniques and technologies must be implemented, even if current process mining tools carry limited functionality (Vergidis, Turner and Tiwari, 2008). Up to 80 % of the recipients in the case of Vergidis et al. responded that they require separate software tools for process mining since the tools embedded in ERP systems can be lackluster. The need for such tools is quite important, though, since process mining can be used for extracting not only business knowledge for Business Process Optimization, but also for extracting whole process models to be used in the design of workflows (Tang, Yong and Jiansa, 2006). The need for separate process mining tools could also imply the need for broader analysis of the processes, since the process data from a dedicated Workflow Management System can differ from the data of ERP systems immensily.

Data or process mining is used also for finding different patterns which form from all the business activities in the enterprise. In the case company of Radeschütz, Schwarz and Niedermann (2015) data mining was used for finding hidden optimization patterns from a data warehouse which contained data from every system used in the enterprise. The optimization patterns were then found through the usage of Online Analytical Processing, as known as OLAP, and an enhanced integrated view was then acquired for the goal of improving the Business Processes in the enterprise. In a similar manner also Process Improvement Patterns were collected in the framework suggested by Lohrmann & Reichert in the year 2014. PIPs might require some more in-depth analysis and work for them to be deployed, though, since they are derived from process models and empirical data. PIPs also contain a collaborative aspect because their implementation is based on organizational Process Improvement objectives and measures, and the parties must be aligned to the common defined goals and decisions.

PIPs are also effective only in the applicable field and framework (Lohrmann & Reichert, 2014). This basically means that the organization should contain some Business Process Management aspect or Business Process Improvement initiative to make the PIPs realized. An example of Total Quality Management (TQM) was given,

but then established to be a bit too general or wide practice for the framework suggested. This might be because of the more administrative or whole quality management aspect of TQM rather than strictly Business Process Improvement aspect. Vergidis et al. (2008) also dictate that management related disciplines such as TQM and Lean lack constistent optimization techniques while a more analytical and on point initiatives might be needed. Lohrmann & Reichert suggest that something like IT Infrastructure Library (ITIL) might work better since it is an established best practices method, and it contains benchmarking methods. Since PIPs are based on common objectives and Process Improvement measures, ITIL could be a good candidate for a framework.

Marjanovic & Roose (2011) also bring out the topic of ERP data and business intelligence (BI) when analyzing the usage of BI-enabled Business Process Improvement in an Australian retail company. Business intelligence is something that can be utilized when redesigning old business processes, but it can also be used to develop altogether new business processes. While Liu et al. (2010) emphasized the effect of transactional and operational ERP data on decision making, Marjanovic & Roose (2011) go beyond the managerial and behavioral aspect by telling that business intelligence and its heterogenous data can enable truly automated workflows. Both research teams agree, though, that business intelligence or data derived from the processes and system itself can be used to benefit both old and new business processes. When thinking about the limited amount of research on post-implementation BPI, the versatility of business intelligence is a strength.

In Marjanovic & Roose's case company (2011), a wiki-based solution was implemented to manage all this business intelligence. The BI system was also used for process benchmarking in its distribution centres. While a business intelligence system such as this is clearly a technical solution, the success factor was not related to the tech itself, but to human resources. This implies that the collaboration and knowledge sharing activities are social, and their success is driven by the passivity or activity of the people themselves. In the future the company does want to make sharing even an integral part of people's work. Lee, Siau and Hong (2003) also bring out the topic of technical versus behavioral, and that in future EAI integration, in example, could focus more on behavior and social level of integration. EAI could include benefits in BI systems as well, since EAI allows to map business processes rather than to re-engineer them straight away (Lee et al., 2003). This kind of integration might provide more accurate data and business intelligence sharing and collaboration across the organization.

Like previously mentioned, in addition to patterns, also whole process models can be extracted using process mining. Not everything can necessarily be usable, though. The standard process models and business blueprint provided by an ERP system might be suitable for some contexts, but they don't suit all customers (Samaranayake & Premaratne, 2009); Shi, Lee, Kuruku, 2007). Similarily the standard methods of business process reengineering (BPR) are not sufficient in developing improved process models (Samaranayake & Premaratne, 2009). While the standard processes are not flexible enough, some level of standardization is needed for making business process automation and integration work. In addition, Nair, Malhotra and Ahire (2011) found out that major Business Process Management practices such as Six Sigma require proper process standardization in ERP while the maturity of Six Sigma didn't have effect on ERP project success against initial predictions. It would seem that major undertakings such as Six Sigma work well, as long as the basis is clearly defined and properly utilized like in the case of business intelligence systems where the social activities are the critical issue.

While standard process models are sometimes ignored and taken for granted, the flow logic and function logic inside these models can be necessary to be analyzed and even changed (Shi, Lee, & Kuruku, 2008). Cardoso, Bostrom and Sheth (2004) issue that there lies a key problem in understanding and changing these process flow models inside ERP, and that there is a trend of integrating different workflow solutions to the existing ERP, most likely because the standard workflow management can be luckluster in ERP software. The role of process models shouldn't understated, nonetheless because the most popular BPI methodologies are model-based, and focused of process modeling, tasks and control flows (Marjanovic & Roose, 2011).

Business process automation is carried out today mainly via standardization (Shi et al, 2007), and this can be enabled with Workflow Management Systems (WfMS) alongside existing ERP solutions. Cardoso, Bostrom, Sheth (2004) claim that ERP systems already include some level of information sharing and workflow functionalities, but they are most often strictly data centric. This has been a key problem, since understanding this data centric process flow can be challenging. There indeed has been a trend where WfMS systems are being integrated with ERP for easier understanding and process modeling, and differiating flow logic from function logic (Shi et al, 2007; Cardoso et al, 2004). In ERP solutions information sharing might not be always fully utilized, but with more of an ad hoc and not so data centric system such as WfMS, the collaboration aspect could be used in a more efficient manner since a similar premise was seen in the case of business intelligence systems. Also Bock et al. (2009) emphasize that an ad hoc nature of local business processes can improve the utilization of ERP systems. An accessible basis and technology could enable a true social collaboration also in this context.

Another similar solution to automating business processes could be using an Business Process Management System. In example, the case company provided by Aguirre-Mayorga, Carreño-Vargas, Vega-Mejía, Castellanos-Arias and Hernández-Martínez (2012), in their efforts to starting to automate the underlying business processes they took up a BPMS system called Bizagi Enterprise. Adopting a new system alongside existing ERP systems and legacy systems might prove problematic, on the other hand, since this requires further integration between these systems. The case company itself recognized the need for integrating the existing systems with the new BPMS system. Further on, Aguirre-Mayorga et al. suggest three different integration approaches to the case study's BPMS integration, with all having their own strengths and weaknesses, meaning that the integration process itself might prove to be challenging and risky. This could water down the initial premise of giving control of the business processes and the information and people involved. Although, because BPMS systems use process modeling and Business Process Notation and their basis (van der Aalst and Weijters, 2004), this could give an enhanced view and further interest to business processes and their improvement if such culture isn't already adopted in a company's management.

The usage of BPMS systems can be enhanced even further. Ramesh, Jain, Nissen and Xu (2005) suggest a tool called KOPeR for diagnosing and improving business processes. The basis of this rule-based tool is in Knowledge-based Systems, but it is enhanced for analyzing contextual knowledge which includes contextual requirements, constraints and assumptions. The design of the tool is founded on the thought that BPMS systems by themselves shouldn't only represent and manipulate business processes, but also maintain the contexts in which processes are defined, modified and implemented. This is due to the fact that sometimes organizations try to fit themselves to the ERP software's requirements and operational philosophies and meanwhile contextual factors are ignored (Ramesh et al., 2005). With the use of a KBS it might be worthwhile to diagnose and analyze even the standard business processes and business

process models if additional data relating to the context can be acquired. If the ERPs standard models and processes have been used as is for years, some hidden factors or issues could be found.

4.2 Analytical solutions

Continuing from Business Process Modeling (BPM), Samaranayake and Premaratne (2009) suggest a framework for Business Process Integration, optimization and automation through the usage enhanced business process models which use the ERP's business blueprint are their basis. The initial reason for using an integrated framework and modeling enhanced business process models was in the under-utilization of the workflow functionalities of ERP system itself. In this framework, integrated process models and data structures are first modeled through Event-driven Process Chains which depicts the workflow between processes, and then automation is carried out in specific business functions with further workflow modeling. Optimization is fulfilled with the elimination of manual functions. Such EPC modeling methodology is needed since SAP, for example, cannot express the direct interactions or relations between different data structures (Samaranayake & Premaratne, 2009). In general, EPC way of modeling also eliminates some of the problems in regular BPM which doesn't depict the data structures of ERP systems and databases. If an organization should use some form of BPM notation, EPC seems like the strong candidate for that even though some kind of BPI framework is not going to be utilized. Some framework would be strongly suggested, though, since as in the case of Aguirre-Mayorga et al. (2012), the integration might prove to be challenging and EPC already provides a basis for frameworks such as presented in figure 2.

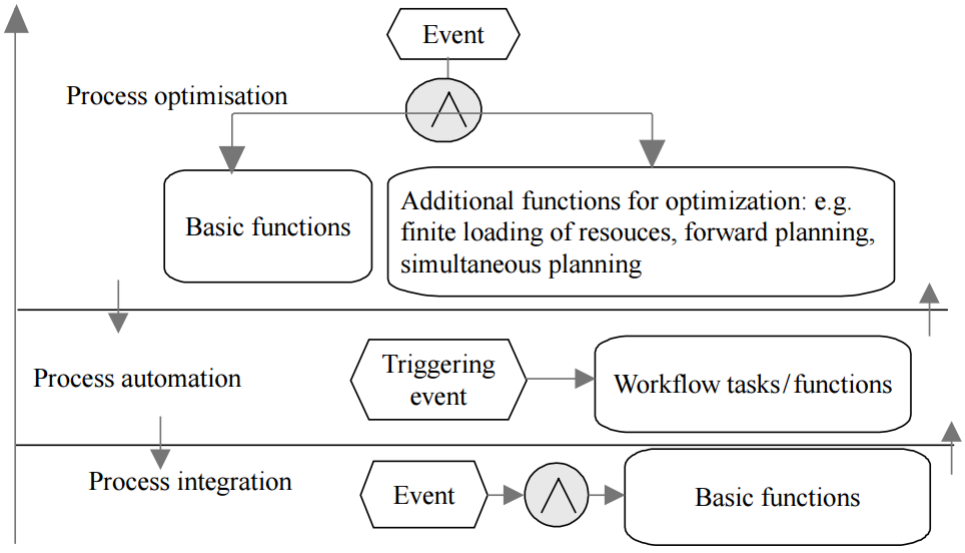

Figure 2. Aguirre-Mayorga et al. (2012)

When using BPM to model the workflows between processes, it is deemed important that the modeling process does not become too separate entity from the actual process of Business Process Improvement. Samarayanake and Premaratne (2009) specify that in ERP software the workflow is often under-utilized because of the separate nature of the business functions inside. Workflow models and process models need to be closely

integrated with the Business Processes and the ERP systems itself for them to be fully benefited. In addition, the workflow software should not be heavily modular or contain many packages that make it more difficult to integrate or use. Themistocleus & Corbitt (2006) claim that one of the reasons for using EAI can be the packagisation of the ERP software or system. While EAI can be a solution in this case as well, it might be controversial for ERP or workflow systems to be packagised when the original premise of these systems is to offer Business Process Integration, i.e. the need for integration inside integration software itself can be peculiar. Using middleware to repair inadequate systems and processes can also bring further granularity and costs to the enterprise.

Some different enhanced views especially relating to data can help the organizations differ their flows of data from each other, and further help the process of integrating business processes. In example, Stohr & Zhao (2001) claim that separating workflow logic from application logic leads to simplified integration of Business Processes, but for such analysis sometimes separate analytical tools such as Petri nets must be used. Simirarily, a resource-based view can help benefit Business Process Integration between different firms (Shi & Lao, 2012). Integrated view suggested by Radeschütz et al. (2015) on the other hand differiates process data including process execution data and paths taken, and operational data including work experience, training done and demographics, from each other for making an integrated Business Impact Analysis (BIA) and further on improving business processes this way.

Furthermore, visualization alone and making a visual view of the business processes can improve the understanding of the aforementioned processes. Dörner, Yetim, Pipek and Wulf (2010) suggest an Service-Oriented Architectures (SOA) based business process modeling framework called SiSO for vizualization and automation of business processes. There is an issue relating to compatability between different applications such as SAP and Excel, though, and this might require the usage of additional integration through EAI which could be a challenge for large and small organizations alike. A SOA based environment such as this can help the experts to understand the underlying functions inside business processes, but the technique of business process analysis is not always enough. Vergidis, Turner and Tiwari (2008) claim that process analysis should not only provide inspection of the processes, but also already generate alternative improved business processes along the way.

4.3 Managerial solutions

For enabling the new improved business processes, the usage of process experts might be necessary. According to Vergidis et al. (2008) process ownership is crucial if the organization doesn't fully support the BPI initiatives, or when the culture towards BPI is lukewarm. In this case, there is a possibility for using IT champions, IT and CS expert teams, process specialists, or improvement specialists (Cardoso et al., 2004; Liu et al., 2010; Nair et al., 2011; Tang et al., 2006) for giving an enchanced knowledge and responsibility of each process and the initiatives and techniques of business process improvement. Separate teams are also needed for attacking workflow issues inside business processes because if some actor doesn't take workflow and business process improvement as their own responsibility, it might be unlikely that the management will. In addition, Six Sigma necessitates the usage of intricate improvement specialists (Nair et al., 2011), and this is likely true also for Lean and Total Quality Management initiatives, which were popular amongst the recipients in the research of Vergidis et al. (2008).

While Lean and Six Sigma tools in addition to using traditional project management techniques in ERP projects can be a powerful combination, these tools can be used for ERP sustainability as well (Jha & Saini, 2011). This is especially true in small and medium enterprises when there is a certain lean ability to using such tools. Jha and Saini (2011) provide a comparative analysis of both of these tools, depicting Lean as more of an ad hoc solution with the focus in learning by doing and using minimal training. Six Sigma on the other hand uses Business Process Modeling and process benchmarking with the goal of reducing variability while Lean tries to eliminate waste or optimizing the Business Processes. This combination alone can be a strong candidate for BPI efforts, but when combined with Business Intelligence systems and their process benchmarking such as in the case company of Marjanovic & Roose (2011), there could lie very effective analysis of the Business Processes inside the organization.

Support from management and resposibility is also important in success of different projects, and Process Improvement projects are no strangers to this either. Stohr and Zhao (2012) write about change management, claiming that projects organizational projects usually fail because of resistance from rigid bureaucracy and the lack of top management support. The resistance to different projects doesn't usually stem from nothing, though, because the way they are implemented can have an impact on resistance as well. In example, if integration is push-oriented, meaning that there hasn't been much collaboration and training involved in the deployment of the integration, pushing can lead to further resistance (Lee, 2003). It is quite clear that the organization's management has to consider everybody in how its projects can have effects on human resources. In addition, some managerial functions might be necessary in coordinating project deployment.

Continuing from human resources, the collaborative aspect is especially strong in Business Process Improvement projects and Business Process analysis tasks. When making analytical decisions based on theory and then going forward to process and workflow design, participation is key in its success (Tang et al., 2006). Making measurements from different data models or structures requires major efforts from process specialists, in example. This is where the power of sharing might be beneficial. In the process of Business Process Interfirm Integration the acts of information sharing, cooperation and joint operations are emphasized even further (Shi & Liao, 2012). When doing large scale BPII, some discrete interfirm teams might be needed coordinate all the interfirm resources.

In the end, team members and human resources are the actual actors that carry out different activities, such as Business Process Integration in the interfirm context. Shi & Lao (2012) claim that capitalization of interfirm resources in highly dependent upon joint teamwork or interfirm team members because they are the true integrators and resource mediators. The systems themselves cannot analyze or automate all the interfirm dependencies when there are multiple processes, activities and transactions running, and interfirm Business Process Integration is about interconnecting all these areas (Shi & Lao, 2012). For coordinating all these activities, Stohr and Zhao (2001) mention some of these: instantiating workflow instances, assigning agents to perform activities, generating worklists, and making reminders for completing certain tasks. In addition to managing these functions, some control functions such as monitoring and reporting performace are needed as well to make sure these functions are operational. Managing and coordinating workflow and resources this way is more of a managerial subject than technical, but it can have straightforward benefits towards cycle time, costs and worker satisfaction (Storh & Zhao, 2001).

4.4 Software vendor interaction and customization

Additional value regarding Business Process Improvement could lie in the interaction between the customer and the ERP vendor, or the software developer as well. Liu et al. (2010) dictate that ERP vendor to customer interaction could essentially be a win-win situation when the communication is mature between these two actors. Dörner et al. (2010) mention also that potential additional research could be made on user and developer collaboration. This kind of collaboration could potentially truly blossom, but in reality there can be numerous obstructions regarding company and retailer size, costs and location. Collaboration with the largest ERP providers such as SAP might prove expensive, and for smaller companies the costs could exceed the perceived collaboration benefits regarding business process improvement. Also, if collaboration leads to modifying and developing ERP product itself, the time and costs extend even further. While improving ERP is one solution in improving the whole business efficiency, and the other is improving existing business processes (Samarayanake & Premaratne, 2009), improving ERP can be impossible for the majority of customers. An argument for customization helping the users act more independently from the vendor exists (Jha & Saina, 2011), however.

If some customer decides to go the customization route, however, Zhang & Long (2004) suggest an Activity Chain ontology for capturing flexibly BP integration requirements. Activity Chain ontology is an XML-based Resource Definition Language which describes different classes and concepts in its schema. When everything from such things method names, input formats and output formats are represented using thing Resource Definition Language, this reduces the amount of code used in the implementation of the functionalities alongside with time and costs used on integrating applications and business processes. This kind of implementation and modeling style goes against the grain of ad hoc integration styles. Zhang & Long (2004) also claim that their solution is Petri net proved, giving a dead-lock free solution to such activity management system.

5. Discussion and conclusions

During the initial material collection it was evident that the research and literature regarding Business Process Improvement methodologies within ERP system environment was still very limited, and this could be seen through the eyes of other researches as well. Plethora of studies were found relating to Business Process Improvement in ERP systems pre-implementation, but finding relevant material within the purpose of this study proved to be somewhat challenging.

Business Process Improvement itself might be too general term to be used in an research revolving around ERP systems. The research done on ERP and its related concepts are usually either very analytical or technical, and while the studies have been somewhat helpful and conclusive, the background theories and concepts have been quite lackluster. References to previous or related studies have been minimal, and even the depiction of study problems have been quickly bypassed when there clearly has been a need for cohesive discussion on the concepts and theories with accurate terminology.

Although a majority of ideas used in this literature review have been quite disconnected from the actual purpose of the studies, a few conclusions can be made relating to the purpose of this study. Firstly, multiple solutions exist in improving Business Processes in an ERP context. Workflow Management Systems and Business Process Management Systems are the most standout technical solutions in this area.

In addition, other solutions can be categorized to either behavioral solutions or managerial solutions. Further on, managerial can be separated to just management and coordination. Analytical solutions can be named as another category, if business process analysis and modeling were to be separated from managerial solutions. Process mining and process benchmarking can be considered as analytical solutions as well. Relating to analytical solutions there could be seen a strong emphasis on different process models and views, and the analytical tools such as OLAP and KOPeR which use these models. Further on, the tools and different modeling and analyzing methods can be integrated using EAI and SOA with the aid of frameworks such as EPC, ITIL and SiSO.

Secondly, while the previous research made on the subject was quite varied in scope, some common concerns were still clearly seen regarding the methodologies and techniques. Most researches brought up the topic of utilization when discussing ERP systems, the usage of different expert teams or individuals in process improvement, or the social collaboration aspect of different technologies. There was a surprising amount of discussion on the view of the users on Business Process Improvement and different systems such as Business Intelligence systems.

This research of strictly focused on the concepts of Business Process Improvement, optimization, integration and automation. The looser terms relating to these such as Business Process Collaboration and Business Process Change were not included in the research since during the material collection it was realized that they were not as established or generalizable concepts as the previously mentioned terms, or that not enough material was to be found relating to the field or context of ERP systems within these terms.

Also relating concepts such as Enterprise Application Integration and Service-oriented Architecture were not deeply referenced in the study although they can have an indirect relation to all the Business Process Improvement efforts. The same thought was applied to concepts such as organizational fit between ERP and processes, ERP utilization, and ERP assimilation. Although they all possess the initial idea of improving the activities and collaboration in such context, they were not strictly related to actual business processes while they might have an effect on them.

In the available research the practices of Business Process Improvement have been unclear chronologically. Rarely the time period and time lines were specified in detail, and when they were, it was later on found out the research was strictly about pre-implementation phase or the deployment phase. Post-implementation phase was only referenced when assessing the success or effects of the ERP system at hand. The writer of this study suggests that there could be an in-detail research on ERP systems and Business Process Improvement activities, methods and practices in stricly post-implementation, or assimilation phase. This calls for such context where the ERP system has been in use for extended periods of time, and where the system has been fully adopted to the organization functionally and culturally. This also might necessitate that a mere time period of months would not be sufficient, but rather years.

There is also a need for further research in relation to different areas and contexts such as different geographical locations, especially Europe and Asia, and different ERP systems. SAP is not the only ERP system in existence, even though it is vastly popular around the globe. If some ERP was directly referenced, it was mainly SAP and its numerous different modules.

The study of organizational fit and relations between enterprise systems and business processes would be of particular interest as well. There were some constant indicators and mentions of needing future research on interrelationships between these organizational factors, but no further implications were done on issues such as organizations trying to fit themselves to the ERP software. While ERP can bring great benefits to automation and integration, in example, ERP is only a tool, not a final solution that solves all problems.

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Appendix A. The abbreviations used.

BI = Business Intelligence
BIA = Business Impact Analysis
BP = Business Process
BPA = Business Process Automation
BPI = Business Process Improvement
BPII = Business Process Interfirm Integration
BPM = Business Process Management
BPMS = Business Process Management System
BPM = Business Process Modeling
BPO = Business Process Optimization
EAI = Enterprise Application Integration
EPC = Event-driven Process Chain
ERP = Enterprise Resource Planning
ES = Enterprise System
KBS = Knowledge-based System
OLAP = Online Analytical Processing
SOA = Service Oriented Architecture
TQM = Total Quality Management
WfMS = Workflow Management System

Appendix B. The material collected

The rows include the databases which were used in making the database queries, and the columns contain the keywords which were used in the database queries.

The first number indicates the amount of search results obtained from the database query, and the number in parentheses indicates the number of articles that were saved for futher analysis and usage.

The key words were mirrored against the keyword ERP or Enterprise Resource Planning using different operators such as AND or OR depending on the database used.

	Business Process Improvement	Business Process Integration	Business Process Automation	Business Process Optimization
ACM Digital Library	14 (2)	19 (0)	9 (0)	4 (0)
IEEE Xplore	56 (5)	80 (1)	45 (0)	23 (2)
EBSCO	6 (0)	16 (1)	6 (1)	2 (0)
ProQuest	16 (3)	26 (2)	15 (1)	7 (1)
SpringerLink	21 (3)	34 (2)	14 (1)	5 (1)
ScienceDirect	58 (2)	71 (0)	22 (2)	13 (0)